month of September, 1930. The days with high flights were the 8th, 13th, 14th, 24th, and 25th.

Computation of the record of September 8 gave a maximum altitude of 35.9 km. A small Bosch instrument was used and due to the multiple adjustments of the pressure element, a deflection of a few tenths of a millimeter of the pressure pen would produce an error ±3 km. in the maximum altitude. Calculating the height only from the hydrogen filling, the size of the balloon, and from the bursting point and elasticity of the balloon rubber, a maximum altitude of 33 km. is obtained. Also, in favor of the maximum altitude of 33 km. is the fact that with it the rate of ascent in the upper levels is constant, while a maximum altitude of 35.9 km. gives an improbable increase in rate of ascent in the highest level.

On September 13 the balloon was equipped with a large Bosch instrument. For this instrument the maximum altitude of 26.5 km. is probably not more than ±0.5 km. in error. This balloon burst prematurely, due possibly to strain caused by the greater weight of the instrument.

September 14 another small instrument was sent up. It entered a cold current at 24 km. and the balloon stopped rising for a time, then went up again and burst at 32.5 km. The pressures and temperatures of the higher layers were obtained from the descent record.

The ascents on the last two days did not reach the desired heights.

The nine flights in September, 1930, reached a mean maximum altitude of 23 km. It is possible to reach altitudes of over 30 km. only with great care and considerable expense.

The results of these high flights together with the higher Hamburg flights from 1926 to 1930 are to be published soon. These results show that an increase of temperature at heights over 30 km. can not be firmly established. The three highest flights of September, 1930, show minimum temperatures of about −55° C. at about 12.5 km. and temperatures approximately 8° higher at the maximum altitudes. This might be partly due to insufficient ventilation and radiation effect.

The results of the September flights indicate that for further work, investigation should be made into air density and ventilation effects on temperature measurements and the following problems are to be solved: (1) Improvement of the pressure measurements; (2) improving the quality of rubber; (3) development of a connecting apparatus whereby the weight of the instrument is distributed evenly over the balloon.—*Translated and abstracted by J. C. Ballard, U. S. Weather Bureau.*

AGREEMENT FOUND IN RECORDS OF FERGUSSON SOUNDING-BALLOON METEOROGRAPHS

By L. T. SAMUELS

[Weather Bureau, Washington]

During the series of sounding-balloon observations made at Royal Center, Ind., during February, 1931 (international month), two meteorographs were attached to the same balloon in a few instances in order to determine the agreement between the individual records. Also, on a few days sounding balloons were released shortly before and shortly after sunset in order to determine any possible effects of insolation on the meteorograph.

In Figure 1 are shown the temperature-altitude graphs of an observation made February 7 when two meteorographs were attached to the same balloon. Meteorograph No. 693 was hung about 80 feet below the balloon and No. 679, about 15 feet lower. The ascensional rate averaged 215 meters per minute up to 9 km. and 187 meters per minute to the highest altitude reached, viz, 17 km. Each of the records was computed independently and an inspection of the graphs (fig. 1) shows very close

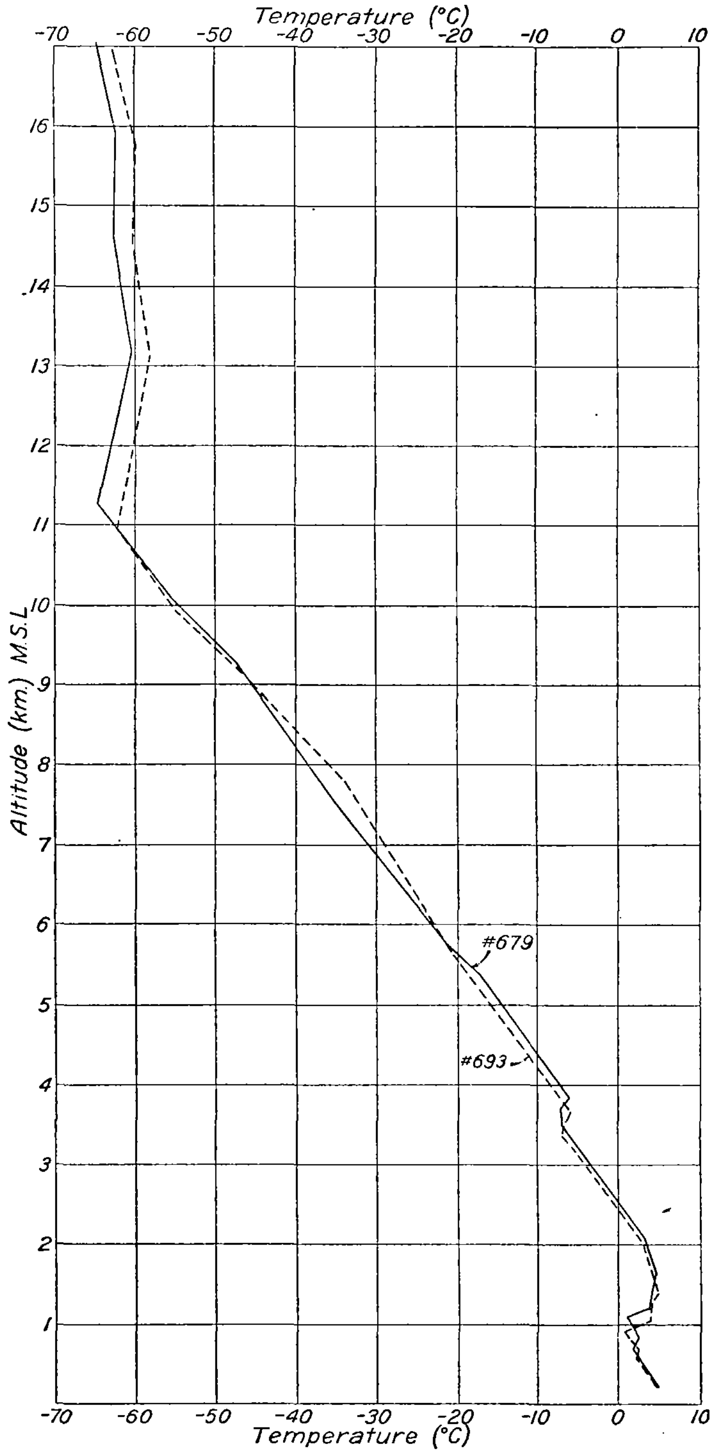

FIGURE 1.—Temperature-altitude graph of sounding-balloon observation using two meteorographs

agreement. It will be noted that at no point does the temperature recorded by both instruments differ by more than 3° C. Two marked inversion layers are shown between 1 and 2 km. and between 3 and 4 km., respectively. The height of the base of the stratosphere agrees to within 300 meters, or 3 per cent. The variations in lapse rate in the stratosphere are in striking agreement.

The relative humidities are likewise found to be in very close agreement. The greatest difference at any particular level was 10 per cent, while in most cases the difference was considerably less.

The general agreement found in the other cases where two instruments were attached to the same balloon was of the same order as that shown in Figure 1.

Figure 2 shows the temperature-altitude graphs of two observations made on February 2, with an interval of 1 hour and 23 minutes between them. The first balloon carrying meteorograph No. 577 was released at 3:55 p. m. (C. S. T.) (69 minutes before sunset), and the second balloon with meteorograph No. 666 at 5:18 p. m., or 14 minutes after sunset.

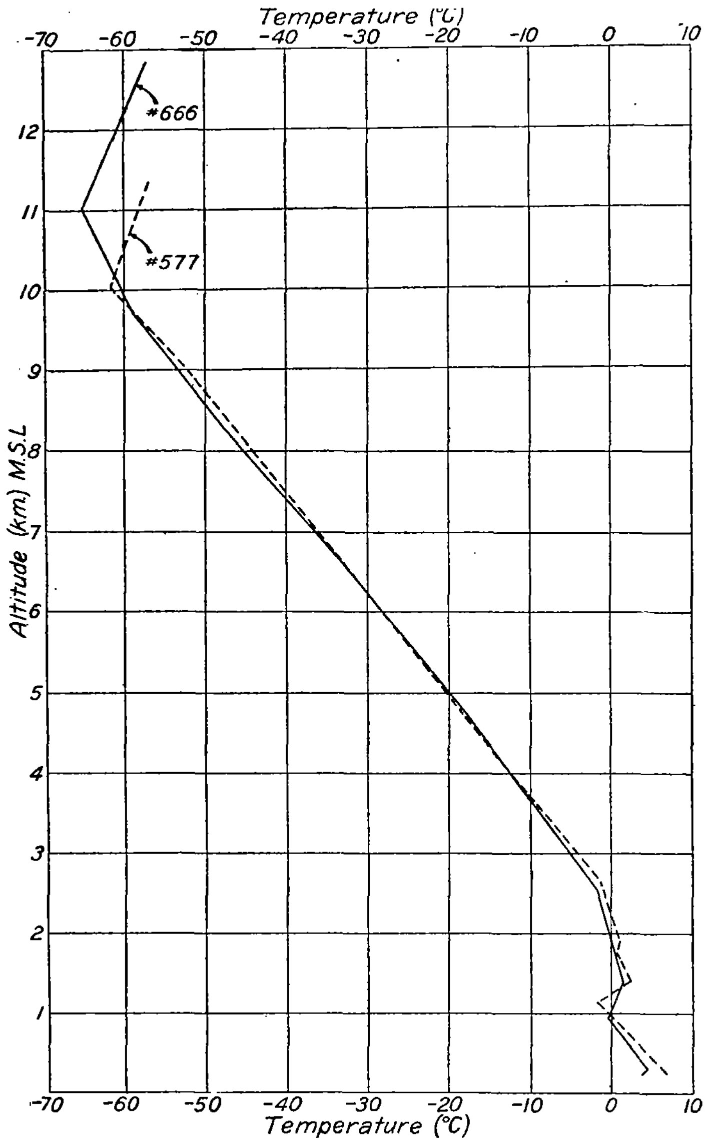

FIGURE 2.—Temperature-altitude graph of two sounding-balloon observations made 1 hour 23 minutes apart

The agreement between the two graphs, it will be seen, is strikingly close up to the base of the stratosphere. The latter is found to be 1 km. higher at the time of the second observation. At least a part of this difference can be attributed to an actual change in atmospheric conditions since the descent portion of the record of the first observation indicated the stratosphere to be about 200 meters higher than on the ascent. A rise in the stratosphere would be expected from the fact that a high pressure area was moving in rapidly over Royal Center at the time.

It is evident that no vitiating effects from insolation resulted.

WHY THE READINGS OF THE MERCURIAL BAROMETER ARE CORRECTED FOR BOTH TEMPERATURE AND LATITUDE AND THE READINGS OF THE ANEROID BAROMETER LEFT UNCHANGED

By W. J. HUMPHREYS

[Weather Bureau, Washington]

It is an old story, of course, why we correct the readings of the mercurial barometer for both temperature and latitude and those of the aneroid for neither. Nevertheless, it may be worth telling again, since there is no convenient literature to which one can refer for an answer to this frequent question.

The aneroid barometer, a vacuum chamber with a flexible top attached to a movable index, responds only to changes in pressure, because the elastic reaction of its inclosed compressed spring that keeps the top from collapsing is practically independent of temperature, within the range of ordinary weather, and wholly independent of gravity. The *pressure* reading of the aneroid therefore needs no correction, save only that which might be necessary to make it agree with that of a standard instrument under the same conditions.

The mercurial barometer, on the other hand, a vertical glass tube sealed at the top, partly filled with mercury (vacuum above) and its open lower end dipping into a basin of mercury exposed to the air, balances, not the pressure of one fluid against a standard spring, as does the aneroid, but the pressures of two fluids against each other where they come together—in this case the pressure of the mercury against that of the air at their interface in the basin. Now, the pressure exerted by the mercury obviously increases directly with the vertical distance between its two surfaces; that is, with the "height" of the barometer, with the density of the mercury, and with the gravity pull per unit mass. But the density of the mercury varies with its temperature and the gravity pull with both latitude and height above sea level. Hence to find the *actual pressure* of the air from the current height of the barometer it is necessary to alter the reading to what it would be at some standard temperature (in addition to the similar correction for scale expansion) and standard gravity.

Why, though, this special interest in the pressure of the air rather than the mass of it overhead, for instance? Because the thing that makes the winds to blow, and thus effects weather transportation, is not primarily inequalities in the mass distribution of the air, but differences between the atmospheric pressures of neighboring places at the same level. This is why we commonly want the readings of our barometers to be in terms of actual pressures, or their equivalents, and that is why ordinarily the readings of the mercurial barometer are corrected for temperature and for latitude (gravity) and why the readings of the aneroid are left unchanged.

If, however, one had occasion to measure, or compare, the masses of air overhead at different places, as he might in the study of solar radiation, he would need to correct the readings of the aneroid barometer for latitude (gravity) and not the readings of the mercurial barometer.